



Well Injection Depth Extraction (WIDE) Soil Flushing

Technology Need:

Innovative technologies are needed for the *in situ* remediation of low permeability soils. Conventional technologies, such as pump and treat groundwater remediation, and vapor extraction using conventional well fields, are typically ineffective when applied to sites with low permeability soils.

Technology Description:

Well Injection Depth Extraction (WIDE) is an innovative *in situ* remediation technology applicable to the remediation of fine grained soils with hydraulic conductivities as low as 10^{-8} cm/s. The technology utilizes closely-spaced Prefabricated Vertical Wells (PVWs), that can be installed rapidly, to extract groundwater and/or soil vapor using an applied vacuum. The PVWs can also be used for injection of liquids in a soil-flushing scheme. Prefabricated Vertical Wells have been used in the geotechnical industry since mid 1950's for dewatering fine grained soil. The WIDE system has been successfully demonstrated for the removal of dissolved-phase contaminants, dense non-aqueous phase liquids (DNAPLs), and light non-aqueous phase liquids (LNAPLs) from the subsurface. A photograph of the demonstration system at DOE's Ashtabula Environmental Management Project (AEMP) is presented in Figure 1.

The WIDE system utilizes PVWs in lieu of conventional wells to extract groundwater and inject liquid flushing agents. PVWs, shown in Figure 2, are constructed of a geosynthetic composite system consisting of an inner core, and an outer filter jacket. The PVWs are used for both extraction of groundwater /gases and injection of flushing solutions. Installed at relatively close spacings (< 3 ft), the PVWs shorten groundwater drainage paths and accelerate soil flushing processes.



Figure 1. WIDE Demonstration System

The PVWs are designed for depth-specific extraction of contaminated plumes with or without concurrent liquid injection. The WIDE technology has been designed to target the source points of a plume, thereby controlling and minimizing the volumes of liquids being extracted.

The PVWs are installed by NILEX's patented process which uses a direct push technology capable of an installation rate of 9 ft/s into firm clay soils. The PVWs are piped together at the surface then a vacuum is applied to

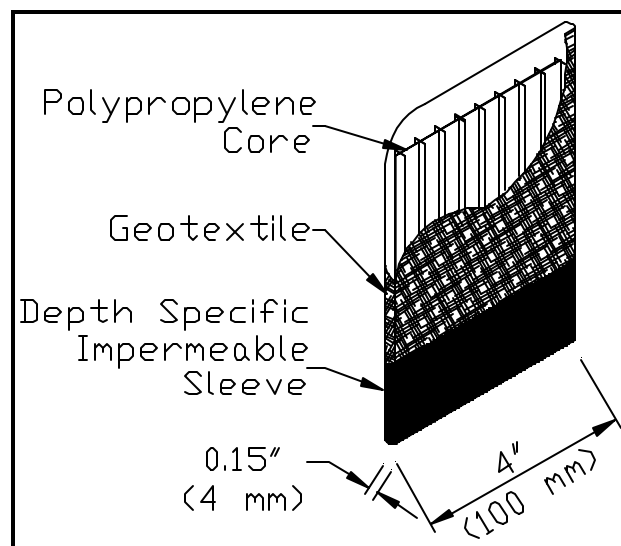


Figure 2. PVW Cross Section

extract the groundwater and volatilize contaminants. Appropriate surface treatment trains are utilized to treat extracted groundwater and vapor.

The WIDE system was developed through DOE-funded research at North Carolina State University (NCSU) and West Virginia University (WVU), in cooperation with the Nilex Corporation. The technology is being commercialized by the Informatics Corporation, Richland, WA.

Benefits:

<Applicable to soils with low hydraulic conductivities (k : 10^{-3} to 10^{-8} cm/s).

<PVWs can be utilized for vapor extraction, liquid extraction, and liquid injection

<Installation of PVWs is rapid and inexpensive with no drilling required.

<PVWs can be economically installed at relatively close spacings (< 3 ft), thereby shortening contaminant transport pathways

<Shorten typical pump and treat remediation durations with reduced long-term operating costs

Status and Accomplishments:

This project was completed in December 2000 and the WIDE system has been demonstrated and deployed at a number of sites. The WIDE system was demonstrated at DOE's Ashtabula Environmental Management Project (AEMP). The site's groundwater and soils are contaminated with trichloroethylene (TCE), uranium (U), and technetium-99 (^{99}Tc). The subsurface remediation is technically challenging due to the glacial till soil exhibiting low hydraulic conductivity (10^{-6} cm/s).

The WIDE system effectively reduced the source of the contamination in relatively short operational times. At one of the monitoring well in the demonstration, the TCE concentration was reduced from an initial concentration of 400,000 $\mu\text{g/l}$ to 160,000 $\mu\text{g/l}$ (60% reduction) in 31 hours of operation.

The WIDE system was also deployed at the Former

Lockbourne Air Force Base located at Rickenbacker Port Authority in Columbus, OH, overseen by the US Army Corps of Engineers. The system was successfully applied for the extraction of free-phase JP-4 petroleum hydrocarbons from soils with hydraulic conductivities ranging from 10^{-7} to 10^{-8} cm/s.

In late 2001, the WIDE system was deployed at the Battelle Columbus Laboratories Decommissioning Project (BCLDP) West Jefferson North Facility. The project will utilize both water and a co-solvent to remove Cesium-137 from the site soil through a closed loop soil flushing system.

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Online Resources

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2172
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>

The Informatics Corporation Internet address is <http://www.informaticscorp.com>

The Nilex Corporation Internet address is <http://www.nilex.com/index.html>

Innovative Technology Summary Reports (ITSRs) for the WIDE Soil Flushing technology may be viewed at: <http://apps.em.doe.gov/ost/pubs/itsrs/itsr2172.pdf//apps.em.doe.gov/ost/pubs/itsrs/itsr2172.pdf>